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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/554,593	10/26/2005	Masaki Hirakata	125746	6661

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EXAMINER	
MILLER, DANIEL H	

ART UNIT	PAPER NUMBER
1794	

MAIL DATE	DELIVERY MODE
12/10/2008	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/554,593	HIRAKATA ET AL.	
	Examiner	Art Unit	
	DANIEL MILLER	1794	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE _3_ MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on _9/3/2008_.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) _1 and 3-58_ is/are pending in the application.

4a) Of the above claim(s) _20-56_ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) _1,3-19,57 and 58_ is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

1. Claims 1, 3-19, 57-58 are rejected under 35 U.S.C. 103(b) as being unpatentable over Tsukamoto (US 7,282,742) in view of Lavin (U.S. 6,426,134B1).

2. For purposes of examination the term “carrier” will be interpreted as an electrical current.

3. Tsukamoto teaches a field effect transistor having a gate a source and a drain electrode (see background and column 8 line 15-40) wherein the nanotubes form a semi-conducting material (“transporter layer”, see examples).

4. The nanotube layer comprises a transporter layer of nanotubes. However, Tsukamoto is silent as to cross-linking sites formed from the carbon nanotubes.

5. Regarding claim 1, Lavin teaches nanotubes with unique electrical and mechanical properties (column 1 line 50-60). Lavin further teaches nanotubes (treated with acid) with one or more carboxylic acid groups (or amine linkages) (column 5 line 47-55; column 3 line 60-65). The nanotubes can be copolymerized (cross-linked) with

precursor polymers and then formed into a chip (a coating that acts as an electrical contact) and bonded to a plug (base body) (column 6 line 6-10).

6. Lavin further teaches for instance a linking of nanotubes with a variety of material including polyurethane and poly(ethylene terephthalate) (see examples); which would necessarily comprise a hydrocarbon of 2-10 carbons, as claimed.

7. It would have been obvious to a person of ordinary skill in the art to form a nanostructure for use in Tsukamoto using the structure of Lavin because the crosslinking of the nanotubes inherently forms a unified and stronger structure, that is superior to alternative weaker molecular forces (i.e. Van der Waal forces) that can bond nanotubes together. Further, the cross linked nanotubes have the added benefit of inherently adding to the electrical properties of the nanotubes.

8. The material of Tsukamoto is considered to act as a “carrier” with voltage applied and a “transporter layer” to the extent to which applicant has defined those terms.

9. Regarding claims 3-4, Given the disclosure of Tsukamoto the electrical configurations claimed by applicant are well known in the art and would be obvious uses and/or configurations to one of ordinary skill in the art.

10. Regarding claim 9, The nanotubes are obtained by curing a solution (see example 1 column 6 line 38-68, column 7 line 1-45 Lavin).

11. Regarding claims 10-14, the cross linking agent is polyamide or polyimide which is not self-polymerizable (column 2 line 62-68 Lavin).

12. Regarding claim 7, the polymers used would inherently form one of the structures of claim 7 because they are the same polymer cross-linking agents as applicants.

13. Regarding claim 15-16, the nanotubes would inherently be bonded and the reaction that linked the nanotubes would inherently be one of the types of reaction enumerated by applicant.

14. Regarding claims 7 and 8 and 12, the nanotubes can have amine or carboxyl functional groups depending on the treatment, as stated above. Therefore, multiple functional groups are inherently bonded together to form cross-linking and the linking site would inherently be COO, COOH, or NH, or NHCOO.

15. Regarding claims 17-19, the carbon nanotubes structure of Tsukamoto are patterned to form “transporting layers”, the substrate is considered to be inherently “flexible” to some degree (see silicon substrate (110) column 5 line 25-30), and the nanotubes are integrated on the substrate (see figures).

16. Regarding claim 5 and 6, it would be obvious to use either single walled or multi walled nanotubes, as taught by Tsukamoto (column 10 line 57-62), since both are inherently capable of forming functional groups and polymerizing and both have similar electrical properties.

17. Regarding claims 9-14, it should be noted that, “even though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim (or limitation) is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process.”, (In re Thorpe, 227 USPQ 964,966). Once the Examiner provides a rationale tending to show that the claimed product

appears to be the same or similar to that of the prior art, although produced by a different process, the burden shifts to applicant to come forward with evidence establishing an unobvious different between the claimed product and the prior art product (In re Marosi, 710 F.2d 798, 802, 218 USPQ 289, 292 (Fed. Cir. 1983), MPEP 2113). Therefore, differentiations in the process are not pertinent to patentability. Therefore, the examiner need only show the claimed cross-linking agents were or are taught, not that the article was subject to “curing” a solution of carbon nanotubes, as claimed by applicant.

1. Claims 1, 3-19, 57 and 58 are rejected under 35 U.S.C. 103(b) as being unpatentable over Tsukamoto (US 7,282,742) in view of Niu et al (High powered electrochemical capacitors based on carbon nanotube electrodes) Appl. Phys. Lett. 70 (11) 17 March 1997) further in view of Lavin (U.S. 6,426,134B1).

2. For purposes of examination the term “network structure" will be taken to encompass any grouping or aggregate of carbon nanotubes.

3. For purposes of examination the term “carrier” will be interpreted as an electrical current.

4. Tsukamoto teaches a field effect transistor having a gate a source and a drain electrode (see background and column 8 line 15-40) wherein the nanotubes form a semi-conducting material (“transporter layer”, see examples).

5. The nanotube layer comprises a transporter layer of nanotubes. However, Tsukamoto is silent as to cross-linking sites formed from the carbon nanotubes.

6. Niu teaches a carbon nanotube sheet electrode comprising highly pure free standing mats of entangled nanotubes with an open porous structure (abstract). The nanotubes are uncontaminated by other forms of carbon or other residue except for a small amount of catalytic residue which is easily removed (column 2 page 1480 Niu). The nanotubes are treated using a removal process comprises a nitric acid treatment that functionalizes the nanotubes and removing metal impurities (column 2 pg. 1480 Niu). The structure is formed by functional groups formed on the nanotubes such as –COOH, OH, and C=O, which after a thermal cross-linking process from a rigid carbon nanotube structure. The recited structures when linked to another functional group could form and would render obvious a connection of 2-10 carbons which would be expected to be formed when linking varied functional groups known to one of ordinary skill. Further see Lavin for evidence of linking groups with similar functionalized groups known to one of ordinary skill in the art. Lavin teaches for instance a linking of nanotubes with a variety of material including polyurethane and poly(ethylene terephthalate) (see examples); which would necessarily <u>comprise</u> a hydrocarbon of 2-10 carbons, as claimed.

7. The nanotubes have a uniform diameter with an average of 80 angstroms and form pores through the spaces in the entangled network with a narrow distribution of pores, essentially free of micropores, with an average diameter of 92 angstroms (pg. 1480-1481 Niu). The structure provides electrical characteristics with a highly

accessible surface area, where electrons don't get rapped in uneven pores, with low resistivity, and high stability (pg 1480 Niu). The nanotube film is taught to be 0.001 in thick and is highly flexible and can be bent into shaped articles (see page 1480-1481 Niu). The process of producing the nanotube structure and the structure of the physical characteristics of the nanotube structure are substantially similar to applicant's structure disclosed in the instant specification.

8. The nanotube structure of Niu is considered to be a network structure, as claimed, and is capable of carrying a current (see Niu page 1482).

9. The nanotube electrode can be used to produce a single cell wherein two nanotube electrodes are separated by a polymer separator (substrate; see page 1481 second column Niu).

10. It would have been obvious to a person of ordinary skill in the art to form a nanostructure for use in Tsukamoto using the structure of Niu because the crosslinking of the nanotubes inherently forms a unified and stronger structure, that is superior to alternative weaker molecular forces (i.e. Van der Waal forces) that can bond nanotubes together. Further, the cross linked nanotubes have the added benefit of inherently adding to the electrical properties of the nanotubes (see disclosure of Niu generally).

11. Regarding claims 3-4, Given the disclosure of Tsukamoto the electrical configurations claimed by applicant are well known in the art and would be obvious uses and/or configurations to one of ordinary skill in the art.

12. Regarding claim 5 and 6, it would be obvious to use either single walled or multi walled nanotubes, as taught by Tsukamoto (column 10 line 57-62 Smalley), since both

are inherently capable of forming functional groups and polymerizing and both have similar electrical properties.

13. Regarding claim 8, the nanotubes of Nui can have a variety of functional groups, as stated above, and therefore, multiple functional groups are inherently bonded together to form cross-linking and the linking site would inherently be those claimed by applicant.

18. Regarding claim 15-16, the nanotubes would inherently be bonded and the reaction that linked the nanotubes would inherently be one of the types of reaction enumerated by applicant.

14. Regarding claims 17-19, the carbon nanotubes structure of Tsukamoto are patterned to form “transporting layers”, the substrate is considered to be inherently “flexible” to some degree (see silicon substrate (110) column 5 line 25-30), and the nanotubes are integrated on the substrate (see figures).

15. Tsukamoto (US 7,282,742) teaches a nanotube film present in a three electrode system, common to one of ordinary skill. It would be obvious to one of ordinary skill to provide a nanotube films having semiconductive or electrical properties by varying the type of connection of the nanotubes (i.e. functional group, or linking agent), concentration levels and, chirality of the nanotubes. See Tsukamoto (US 7,282,742) for evidence of a known semiconductive film and Niu for evidence of a film that forms an electrically conductive electrode from functionalized and connected nanotubes. Given the teachings of the cited references, which disclose information known by one of ordinary skill at the time of the invention, it would have been obvious to provide either a

nanotube film having either electrical or semiconductive properties, providing a nanotube film as the electrode, as in Niu, and a different layer for the semiconductive film as in Tsukamoto, or both in order to form a functional three electrode system of Tsukamoto. No patentable distinction is seen.

16. Claims 1, 3-19, 57 and 58 are rejected under 35 U.S.C. 103(b) as being unpatentable over Tsukamoto (US 7,282,742) in view of Tour (US 7,250,147).

17. For purposes of examination the term “network structure" will be taken to encompass any grouping or aggregate of carbon nanotubes.

18. For purposes of examination the term “carrier” will be interpreted as an electrical current.

19. Tsukamoto teaches a field effect transistor having a gate a source and a drain electrode (see background and column 8 line 15-40) wherein the nanotubes form a semi-conducting material (“transporter layer”, see examples). Tsukamoto’s taught semi-conducting material comprises dispersed nanotubes in a polymer; wherein the presence of the nanotubes allow for an increase in mobility (of current) of about 40 times that of the polymer material without the presence of nanotubes (see example 1)

20. The material of Tsukamoto is considered to act as a “carrier” with voltage applied and a “transporter layer” to the extent to which applicant has defined those terms.

21. The nanotube layer comprises a transporter layer of nanotubes. However, Tsukamoto is silent as to cross-linking sites formed from the carbon nanotubes.

22. Tour teaches a process of chemically modifying carbon nanotubes using a linking agent (diazonium species) to link single and /or multi-walled nanotubes to one another (abstract). The nanotubes can be used for polymer composites and electrical applications (abstract). Applicant's claimed cross linking sites and functional groups, including hydrocarbons having between 2-10 carbon atoms (i.e. benzene rings found in intermediate structure of linking agents), are taught or would be otherwise inherently formed during cross linking of the nanotubes of Tour (see figures). No patentable distinction is seen.

23. It would have been obvious to one of ordinary skill in the art at the time of the invention to provide the nanotubes of Tour in the polymer semi-conductive material of Tsukamoto because the cross linked nanotubes of Tour are designed to be used for polymer composites and electrical applications (abstract Tour), and can even be specifically designed to interact with specific polymers and enhance electrical current mobility (Tour column 3-4 lines 60-10).

24. It would also have been obvious to a person of ordinary skill in the art to form a nanostructure for use in Tsukamoto using the structure of Tour because the cross-linking of the nanotubes inherently forms a unified and stronger structure, that is superior to alternative weaker molecular forces (i.e. Van der Waal forces) that can bond nanotubes together. Further, the cross linked nanotubes have the added benefit of

inherently adding to the electrical properties of the nanotubes (see disclosure of Tour generally).

25. Regarding claims 3-4, Given the disclosure of Tsukamoto the electrical configurations claimed by applicant are well known in the art and would be obvious uses and/or configurations to one of ordinary skill in the art.

26. Regarding claim 5 and 6, it would be obvious to use either single walled or multi walled nanotubes, as taught by Tsukamoto and Tour, since both are inherently capable of forming functional groups and polymerizing and both have similar electrical properties.

27. Regarding claims 9-14, it should be noted that, “even though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim (or limitation) is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process.”, (In re Thorpe, 227 USPQ 964,966). Once the Examiner provides a rationale tending to show that the claimed product appears to be the same or similar to that of the prior art, although produced by a different process, the burden shifts to applicant to come forward with evidence establishing an unobvious different between the claimed product and the prior art product (In re Marosi, 710 F.2d 798, 802, 218 USPQ 289, 292 (Fed. Cir. 1983), MPEP 2113). Therefore, differentiations in the process are not pertinent to patentability. Therefore, the examiner need only show the claimed cross-linking agents were or are

taught, not that the article was subject to “curing” a solution of carbon nanotubes, as claimed by applicant.

19. Regarding claim 15-16, the nanotubes would inherently be bonded and the reaction that linked the nanotubes would inherently be one of the types of reaction enumerated by applicant.

28. Regarding claims 17-19, the carbon nanotubes structure of Tsukamoto are patterned to form “transporting layers”, the substrate is considered to be inherently “flexible” to some degree (see silicon substrate (110) column 5 line 25-30), and the nanotubes are integrated on the substrate (see figures).

Response to Arguments

20. Applicant's arguments with respect to the pending claims have been considered but are deemed not persuasive.

21. The 112 rejections asserted last rejection have been withdrawn due to applicant's amendment .

22. New 103 rejections have been asserted in view of Amendment to the claims (See above).

23. With regards to applicant’s arguments that the functionalization of the nanotubes of Tsukamoto would change the functionality, Tsukamoto (US 7,282,742) teaches a nanotube film present in a three electrode system, common to one of ordinary skill. It would be obvious to one of ordinary skill to provide a nanotube films having

semiconductive or electrical properties by varying the type of connection of the nanotubes (i.e. functional group, or linking agent), nanotube concentration levels and, chirality of the nanotubes. See Tsukamoto (US 7,282,742) for evidence of a known semiconductive film and Niu for evidence of a film that forms an electrically conductive electrode from functionalized and connected nanotubes. Given the teachings of the cited references, which disclose information known by one of ordinary skill at the time of the invention, it would have been obvious to provide either a nanotube film having either electrical or semiconductive properties, providing a nanotube film as the electrode, as in Niu, and a different layer for the semiconductive film as in Tsukamoto, or both in order to form a functional three electrode system of Tsukamoto. No patentable distinction is seen.

Conclusion

24. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP

§ 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to DANIEL MILLER whose telephone number is (571)272-1534. The examiner can normally be reached on M-FTh.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Keith Hendricks can be reached on (571)272-14011. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Daniel Miller

/KEITH D. HENDRICKS/

Supervisory Patent Examiner, Art Unit 1794